

Magnetic Suspension for Dynamic Spin Rig



NASA Lewis' Dynamic Spin Rig.

NASA Lewis Research Center's Dynamic Spin Rig, located in Building 5, Test Cell CW-18 (see the preceding photo), is used to test turbomachinery blades and components by rotating them in a vacuum chamber. A team from Lewis' Machine Dynamics Branch successfully integrated a magnetic bearing and control system into the Dynamic Spin Rig (see the following photo). The magnetic bearing worked very well both to support and shake the shaft. It was demonstrated that the magnetic bearing can transmit more vibrational energy into the shaft and excite some blade modes to larger amplitudes than the existing electromagnetic shakers can.



Radial magnetic bearing in NASA Lewis' Dynamic Spin Rig showing viscoelastic damped

composite plates attached to the rotor.

Experiments were successfully conducted with the University of California, San Diego, on the damping of composite plates. These experiments demonstrated the system's robustness for long-term testing. Also, our team discovered that the bearing can use feedback from the blade's strain gauges to provide blade damping. This is an additional benefit since insufficient blade damping is a critical problem in advanced turbomachinery blades.

The success of the initial work led to the development and design of a full magnetic suspension system (using three magnetic bearings) for the Dynamic Spin Rig. The upgraded facility provides either a mechanical or magnetic support system for rotors. The magnetic support will enable longer run times for rotating blades at higher speeds and larger vibration amplitudes.

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